

# Cutting Congruent Halves

## Materials

- Paper rectangles, 3" by 4" (about 6 for class demonstration)
- Construction paper (about 2 sheets per student)
- Prepared Shape Halves
- Paper squares, about 3", cut from plain paper (about 5 per student)
- Student Sheet 23 (1 per student, homework)
- Scissors
- Paste or glue sticks
- Chart paper
- Envelopes or resealable plastic bags

## What Happens

Students fold and cut different shapes into congruent halves, then make a shape of their own that can be cut and folded in half. Near the end of Session 5, they discuss which numbers will make half-and-half rectangles. Their work focuses on:

- folding and cutting shapes into congruent halves
- constructing a shape that can be folded and cut into congruent halves

## Start-Up

**Homework** Students share examples of things they found around the house that are in halves. You may want to start a list or a collection of objects that come in halves.

**Quick Images** Using the dot arrays, flash an image on the overhead projector. Ask students to tell how many, and how the arrangement of dots helped them figure out how many were shown. See p. 125 for complete details on this routine.

## Activity

### Introducing Shape Halves

Introduce the new Choice Time activity.

Mr. Shape-O has a shape shop where he makes shapes. Children often take one shape to share between them. He makes shapes that can be cut in half. The halves are the same size and shape. Some shapes can be cut in half in more than one way, and some can be cut in half in only one way.



Hold up a paper rectangle and ask a volunteer to fold it in half, then cut it. Ask if anyone can cut it in half a different way. After each cutting, compare to see whether the two halves are the same. If it comes up, discuss whether halves are the same if they are cut in a different direction. For example, are diagonal halves the same if one shape was cut from the top left to the bottom right and another from the bottom left to the top right?

If a student cuts the rectangle into two pieces that are not equal, let another student pick which of the pieces they would prefer and ask if the sharing is fair.

If you wish, introduce or review the word *congruent* by placing one half on top of the other.

These two halves are congruent—they are exactly the same size and shape. When I place one half on top of the other half, they match exactly.

Show students the prepared envelopes containing the shapes cut from Shape Halves.

Mr. Shape-O has made 12 different shapes. Choose one shape that you would like to share and try folding and cutting it into congruent halves. After you have cut a shape in half one way, take another one from the envelope and see if you can find a different way to cut it in half. Glue the halves on a sheet of construction paper. If you have cut a shape in halves in more than one way, show all the ways for the same shape on one sheet of paper.

Students can work with one shape now, finding ways to cut it in half and pasting the halves on a sheet of paper. They can continue working with other shapes during Choice Time.

## Activity

### Choice Time

Add the new Choice Time activity to the list. For a review of the materials, setup information, and suggestions on what to watch for as you observe students for Half-and-Half Rectangles, Halves of Geoblocks, and Halves and Not Halves, refer to p. 77.

1. Half-and-Half Rectangles
2. Halves of Geoblocks
3. Halves and Not Halves
4. Shape Halves

Students will continue Choice Time through about half of Session 5. At that time a discussion will take place on Half-and-Half Rectangles. Monitor students to be sure they have completed this activity by that time.

### **Choice 4: Shape Halves**

**Materials:** Prepared Shape Halves, scissors, 3" paper squares, construction paper, paste or glue sticks

Students select three or four different shapes from the student sheets and cut them into congruent halves. They see if they can find more than one way to make congruent halves for each shape. They paste their shapes on construction paper, putting all halves for the same shape on the one paper.

When students have finished cutting three or four shapes into congruent halves, they use paper squares to design their own shapes that can be cut into halves. Pose a problem such as the following:

Mr. Shape-O is always looking for new shape designs. What would be a good shape for his shop? Design your own shape. Remember, you must be able to cut your shape into two pieces that are the same size and shape.

### **Observing the Students**

#### **Shape Halves**

Use the following questions as a guide while you observe students working.

- Is it obvious to students how to cut the shapes in halves? After cutting a shape in half one way, do they look for other ways to cut it?

Observe how students design their own shapes.

- What kinds of shapes do they draw? Ask them how they know their shapes can be cut into congruent halves.
- Do students first draw the entire shape and then figure out how to cut it? Do any students fold a paper in half and then cut out a shape? (They will be doing a similar activity in the next investigation.)

Students can display their shape designs for others to see. You may want to trace the shapes on paper and duplicate them. Then students can cut one another's shapes into congruent halves.

## **Activity**

### **Class Discussion: Which Rectangles Make Halves?**

About 15 minutes before the end of Session 5, ask students to take out all the half-and-half rectangles they made.

There are a couple of ways you can have students share their results. You may wish to do some combination of the following.

- Review each number in sequential order to see which numbers students were able to build half-and-half rectangles for and which they found impossible. Record the numbers in two lists on the board. Also keep track of the numbers that no one investigated. (These could be homework.)

- Ask students who found half-and-half rectangles for the same number to get together to compare their rectangles and see if they (1) made the same rectangle, and (2) colored them in the same half-and-half pattern. For example, some students investigating the number 12 may have made a 3-by-4 rectangle and other students may have made a 2-by-6 rectangle. Even if students made the same rectangle, there are many ways to make them half one color and half another.

Ask students to look for a pattern that helps them predict which numbers can be made into half-and-half rectangles and which numbers cannot. On chart paper, start a two-column class chart labeled *Halves* and *Not Halves*. If you want to list numbers sequentially, ask students to make half-and-half rectangles for the numbers 1, 2, 3, 4, and 5, and review what they found out for 6 and 7, when the activity was introduced.

<u>Halves</u>	<u>Not Halves</u>
2	1
4	3
6	5
8	7
10	9

## Sessions 3, 4, and 5 Follow Up

**Designing Shapes That Can Be Cut in Half** After Session 4, students design shapes that can be cut in half. They draw pictures of the shapes on Student Sheet 23, Designing Shapes That Can Be Cut in Half.

## Activity



## Homework

## **Designing Shapes That Can Be Cut in Half**

Design shapes that can be cut into two equal halves.

Can you design a shape that can be cut into two equal halves more than one way? You might want to cut these squares out and fold them or cut your designs in half to check.
